Ollscoil na hÉireann, Gaillimh *GX_____*

National University of Ireland, Galway

Spring Examinations 2008

Exam Code(s)	3IF1, 1EM
Exam(s)	3rd B.Sc. In Information Technology
Module Code(s)	CT332
Module(s)	Database Systems II
Paper No.	
Repeat Paper	
External Examiner(s)	Prof. John A. Keane
Internal Examiner(s)	Prof. G. Lyons Mr. C. O'Riordan
Instructions	Answer any 3 questions All questions carry equal marks.
Duration	3 hours
No. of Answer books	1
No. of Pages	2
Department(s)	Information Technology

OLLSCOIL na hEIREANN
THE NATIONAL UNIVERSITY of IRELAND

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SPRING EXAMINATIONS 2008

Third University Examination in Information Technology

CT332 DATABASE SYSTEMS II

Q.1. i) Discuss the properties of a well designed relational schema. Explain the main steps in design by synthesis and explain how the resulting database schema may have the properties of a well designed relational schema. (14)

ii) Illustrate, with an example, the types of data anomalies that can arise if a relation violates second or third normal form. (6)

iii) Given R = {A, B, C, D, E, F, G, H, I} and the following functional dependencies:

- {A,B,C}→ {D, E, F}
- {A,B} → {G}
- {G} → {B}
- {C} → {H}
- {H} → {I}

decompose R to a set of relations such that all relations satisfy BCNF. (7)

iv) Explain, with examples, when and where de-normalisation is appropriate. (6)

Q.2. i) Explain what is meant by *two-phase locking.* With a suitable example, show how the *incorrect summary problem* may arise in a system without suitable concurrency control measures in place. Show how the same schedule would proceed under a system operating under two phase locking. You may assume shared and exclusive locks. (10)

ii) Define the term *conflict-serializability*. Show that all schedules allowed under two-phase locking are *conflict-serializable*. (6)

iii) Explain, with respect to recovery, the importance of a *commit point* of a transaction. Explain, with an example, how the recovery mechanism would proceed in a system operating under the immediate update protocol. (9)

iv) Describe, with a suitable example, how the notion of a commit point may be extended to operate in a distributed database. (8)

Q.3 i) Given the following relational schema:

AUTHOR:	id, paper_id
PAPER:	paper_id, title, year, location
PROJECT:	pno, pname, desc
WORKS_ON:	pno, id

Develop an SQL queries to satisfy the following information need:

List all people who have written a paper in 2003 or 2004 or who work on a project name "Collab_Filtering" or "GP". (6)

ii) Describe the process of heuristic optimisation. Illustrate the process with the query developed in i). (12)

iii) Describe algorithms that can be used for efficient evaluation of the join operator. (8)

iv) Explain how a join operator can be made even more efficient with a parallel architecture. (7)

Q.4. i) Compare object-oriented and relational models – describe the differences in models and query languages supported. (8)

ii) Explain the steps you follow to map an EER model to a suitable design for an object-oriented database. (8)

iii) With respect to deductive databases, discuss briefly how queries are answered by the deductive databases. Comment on the expressiveness of the Datalog query language in comparison to SQL in a relational database. (8)

iv) Consider the following simple fragment from a deductive database schema:

```
publication(p_id, name, year).
person(a_id, a_name).
wrote(a_id, p_id).
```

Develop simple Datalog queries to handle the following information needs:

a) List all publications published in 1999 or 2003.
b) List the name of all papers written in 2003 or written by an author name "murphy"
c) List all people who have written a paper with "murphy". (9)